APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/548,637	04/13/2000	John R Koza	50291.P009	6771

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EXAMINER
WONG, LUT

ART UNIT	PAPER NUMBER
2129	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

	Application No.	Applicant(s)
Office Action Summary	09/548,637	KOZA ET AL.
	Examiner	Art Unit	
	LUT WONG	2129	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address* --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
  Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on <u>21 September 2009</u>.
2a) ☐ This action is **FINAL**.   2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) <u>1-6, 13, 15-23</u> is/are pending in the application.
    4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) <u>1-6,13 and 15-23</u> is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
    a) ☐ All   b) ☐ Some * c) ☐ None of:
        1. ☐ Certified copies of the priority documents have been received.
        2. ☐ Certified copies of the priority documents have been received in Application No. _____.
        3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail. Date _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/25/2010 has been entered.

Status of Claims

Claims 1-6, 13, 15-23 are pending. Claims 1, 22-23 have been amended. Claim 14 is canceled.

Record keeping

Drawing objection is maintained.

Response to Arguments

Applicant's arguments, see pg. 8, filed 2/25/2010, with respect to 101 rejection have been fully considered and are persuasive. The rejection of claim 23 has been withdrawn.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or
> described as set forth in section 102 of this title, if the differences between the subject
> matter sought to be patented and the prior art are such that the subject matter as a
> whole would have been obvious at the time the invention was made to a person having
> ordinary skill in the art to which said subject matter pertains. Patentability shall not be
> negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148

USPQ 459 (1966), that are applied for establishing a background for determining

obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 1-6, 13 and 15-23 are rejected under 35 U.S.C. 103(a) as being

unpatentable over applicants' admitted prior arts (APA) by Koza et al, (US

5867397) in view of another APA (Ullman, J.R), and Beasley et al ("An overview of

Genetic Algorithms: Part 2, Research Topics" 1993).

Previously presented claims 1, 22-23 are drawn to creating a novel design using

genetic programming. Koza et al teaches creating design that satisfy technical

requirement by using genetic programming (See e.g. applicant's own spec pg. 2, 9, 11-

13, 37). Koze et al teaches determining fitness of entities, selecting entities, and

creating new entities (See e.g. applicant's own spec pg. 9). Koza et al does not teach

creating *novel design* that satisfying both technical requirement and having

characteristic not in prior art. However, one of ordinary skill in the art would know that

the only difference in "creating a design" to "creating a *novel design*" is adding one more constraint to the multiobjective function. Such constraint is, of course, requiring the designed entity having characteristic not in prior art. Hence, one of ordinary skill in the art whom is aware of "novelty design" would immediately motivated to added another variable in the objective function or fitness measure to obtain a predictable result of "creating novel design". Isomorphism value, as admitted by the applicant, is one of the many well known method that can be used to represent dissimilarity between candidate entity and the prior art (See e.g. applicant's own spec pg. 95). Hence, one of ordinary skill in the art could have applied the isomorphism value together with the technical requirement as a measure of fitness to achieve the predictable result of "creating novel design". It is merely applying known technique to known method. See *MPEP 2142*.

Currently amended claims 1, 22-23 added a new limitation of "initializing a plurality of candidate entities and an iteration count with a predetermined value <u>by supplying, from an external source, at least one candidate entity partially satisfying the predetermined design requirement which includes a characteristic of the reference structure to the initialized plurality of candidate entities</u>;" *EN:* claim interpretation: drawn to initializing population using domain knowledge".

While the combination of Koza and Ullman teaches creating novel design using isomorphism value, the combination nevertheless uses randomized initialization method. Therefore, the combination fails to teach knowledge expert initialization of genetic algorithm.

However, Beasley teaches applying domain knowledge in initializing the GA

population. See screenshot below.

13 Knowledge-based Techniques

While most research has gone into GAs using the traditional crossover and mutation operators, some have advocated designing new operators for each task, using domain knowledge [Dav91d]. This makes each GA more task specific (less robust), but may improve performance significantly. Where a GA is being designed to tackle a real-world problem, and has to compete with other search and optimisation techniques, the incorporation of domain knowledge often makes sense.

Suh & Van Gucht [SVG87] and Grefenstette [Gre87] argue that problem-specific knowledge can usefully be incorporated into the crossover operation. Domain knowledge may be used to prevent obviously unfit chromosomes, or those which would violate problem constraints, from being produced in the first place. This avoids wasting time evaluating such individuals, and avoids introducing poor performers into the population.

For example, Davidor [Dav91a] designed "analogous crossover" for his task in robotic trajectory generation. This used local information in the chromosome (i.e. the values of just a few genes) to decide which crossover sites would be certain to yield unfit offspring.

Domain knowledge can also be used to design local improvement operators, which allow more efficient exploration of the search space around good points [SVG87]. It can also be used to perform heuristic initialisation of the population, so that search begins with some reasonably good points, rather than a random set [Gre87, SG88].

Goldberg [Gol89a, p201–0] describes techniques for adding knowledge-directed crossover and mutation. He also discusses the hybridisation of GAs with other search techniques (as does Davis [Dav91d]).

Beasley also made it clear why one skill in the art would use domain knowledge

in initializing GA population. See above that domain knowledge allows more efficient

exploration of the search space.

Therefore, one skill in the art would/could have modified the combinations of

Koza and Ullman by using domain knowledge initialization of population as opposed to

randomized initialization. It is merely applying a known technique to a known device

(method, or product) ready for improvement to yield predictable results. See *MPEP*

2142.

Applicant's own spec is relied upon for the following dependent claims. In

particular, the following limitations are included in the " background of the invention"

section of the spec, therefore are well known and admitted prior art.

Claim 2: (See e.g. applicant's own spec at pg. 9, L15 which teaches that the feature of mutation is known).

Claim 3: (See e.g. applicant's own spec at pg. 2 which teaches that the feature of simulating annealing is known).

Claim 4: (See e.g. applicant's own spec at pg. 2 which teaches that the feature of hill climbing is known).

Claim 5: (See e.g. applicant's own spec at pg. 9 which teaches that the feature of population is known).

Claim 6: (See e.g. applicant's own spec at pg. 9, L13 which teaches that the feature of crossover is known).

Claim 13: (See e.g. applicant's own spec at pg. 9, L3 which teaches that the feature of random process is known).

Claim 15: (See e.g. applicant's own spec at pg. 37 which teaches that the feature of simulation is known).

Claim 16: (See e.g. applicant's own spec at pg. 37 which teaches that the feature of avoiding simulation is known).

Claim 17: (See e.g. applicant's own spec at pg. 16, L15-17 on constrained syntactic structure is known).

Claim 18: (See e.g. applicant's own spec at pg. 11, L16-20 and pg. 12, L10-20 which teaches that the feature of electrical circuit is known).

Claim 19: (See e.g. applicant's own spec at pg. 11, L21 and pg 12, L4 which teaches that the feature of controller is known).

Claim 20: (See e.g. applicant's own spec at pg. 12, L4-6 and pg. 13, L3-7 which

teaches that the feature of antenna is known).

Claim 21: a mechanical system is obvious over circuit, controller, and antenna. It

is merely a simple substitution of one known, equivalent element for another to obtain

predictable result. I.e. one can evolve a mechanical system using the same method

that evolve circuit, controller and antenna. The only difference is substituting electrical

component with mechanical component.

Response to Arguments

Applicant's arguments, see pg. 9, filed 2/25/2010, with respect to the rejection(s)

of claim(s) 1-6, 13-23 under Koza and Ullman have been fully considered and are

persuasive. Therefore, the rejection has been withdrawn. However, upon further

consideration, a new ground(s) of rejection is made in view of Koza, Ullman and

Beasley.

Pertinent prior art

The prior art made of record and not relied upon is considered pertinent to

applicant's disclosure.

Thompson et al ("Explorations in design space: Unconventional electronics

design through artificial evolution" 1999) teaches using Evolutionary Algorithm to find

new useful designs. See abstract and section c in particular.

Kallel et al ("Alternative random initialization in genetic algorithms" 1997) teaches alternatives to random initialization, such as using domain knowledge. See e.g. abstract.

Louis et al ("Domain knowledge for genetic algorithms" 1995) teaches combining Domain knowledge with genetic algorithms. See e.g. abstract and Fig. 3 in particular.

Ramsey et al ("case-based initialization of genetic algorithms" 1993) teaches case-based initialization (i.e. non randomized) of genetic algorithms. See e.g. abstract.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to LUT WONG whose telephone number is (571)270-1123. The examiner can normally be reached on M-F 7:30-5.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Donald Sparks can be reached on (571) 272-4201. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the

Patent Application Information Retrieval (PAIR) system. Status information for

published applications may be obtained from either Private PAIR or Public PAIR.

Status information for unpublished applications is available through Private PAIR only.

For more information about the PAIR system, see http://pair-direct.uspto.gov. Should

you have questions on access to the Private PAIR system, contact the Electronic

Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a

USPTO Customer Service Representative or access to the automated information

system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Lut Wong/   /Donald Sparks/
Examiner, Art Unit 2129   Supervisory Patent Examiner, Art
                                                     Unit 2129